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Stead's Circulating Generators for Steam Boilers.

THROUGH the courtesy of the editors of the *Indianapolis Mechanical Journal* we are able to place before our readers an engraving and a description of what appears to us an important improvement in steam-generating apparatus.

The inventor is the engineer in Faber's celebrated pencil manufactory. The invention is placed on the market by the Iron-Clad Manufacturing Co., Greenpoint Avenue, Brooklyn, E. D. Messrs. Moore and Kerrick, Nos. 153 to 164 South Pennsylvania Street, Indianapolis, are also, we believe, acting as agents for the sale of the improvement.

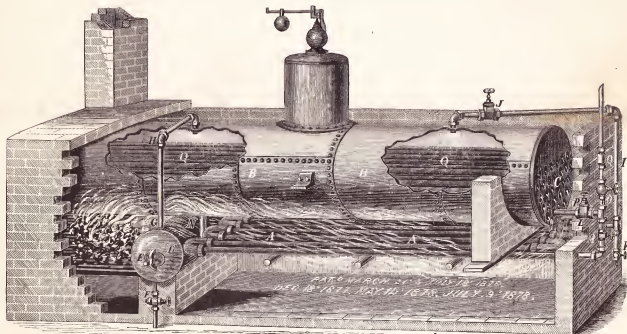
heating surface. The absolute amount of water primed is so small as to warrant the statement that the steam made was practically, thoroughly dry."

This extract indicates a remarkable efficiency in the improvement, which is claimed to be as well adapted to marine as to land boilers, a claim the validity of which is, we are informed, soon to be tested in a trial upon one of the steamers plying between this port and Brazil. No feed-water heater is needed, as the apparatus itself performs this function.

Besides the important economy named above, the advantages of equalized expansion and contraction, prevention and removal of scale, increased safety, cheapness, and facility in application, are claimed. Regarding the

etc., that it previously entered the boiler, and in its passage through the coil it is heated to a temperature ranging from 240°, to 310°, and enters the boiler through the pipe L, combined steam and water. J is a stop-valve between the coil and boiler, and K is a blow-cock for clearing the coil. When the feed is stopped the pressure in the boiler gives full opening to the check-valve L on the pipe P, and the water from the boiler passes down into the coil, through which by its increasing temperature it circulates with great rapidity to the boiler again. The check-valve L was designed for this purpose, and gives full and direct opening to pipe, and cannot stick or fail to work perfectly.

D is a riveted cast-steel drum, taking the



STEAD'S CIRCULATING GENERATOR FOR STEAM BOILERS.

Professor R. H. Thurston, of Stevens Institute of Technology, Hoboken, N. J., has, we are informed, made exhaustive tests to ascertain the economical value of the improvement. We have been promised a copy of his report of the tests, but at present writing it has not come to hand. We have been put in possession of a printed copy of his letter accompanying the delivery of the report to H. W. Shepard, Esq., President of the Iron-Clad Manufacturing Company, from which we make the following quotation:

"From the average result of the trial it is concluded that the (40-horse power horizontal tubular) boiler tested May 23d, 1878, at Faber's Pencil Works, Greenpoint, having the 'Stead Circulating Generator' attached, exhibited an unusually high evaporative power, equivalent to 11.67 pounds water evaporated per pound of combustible, thus utilizing 78 per cent of the heat generated by the combustion of the fuel. The boiler exhibited a steaming capacity . . . equivalent to a duty of one-horse power from each 12.33 square feet of heating surface, making the capacity of the boiler 62-horse power. This is also exceptionally good. The amount of priming as measured (0.26 per cent) is remarkable for a boiler having no super-

latter point it is asserted that the attachment may be applied to most boilers now in use in a single day if required, as no tearing down of the setting or extensive alteration is required.

The rapid and constant circulation of water through the attachment protects it from burning out, and also prevents the formation of scale. The important element of durability is thus secured.

The construction and operation of the attachment will be easily understood on reference to the engraving.

A A is a series of heavy lap-welded pipes, connected by return bends resting on bearers and forming a continuous close coil under the boiler, from the bridge wall to the back connection, making a chamber in which the combustion of gases from the furnace is maintained and the flame held in close contact with the boiler until it strikes the deflecting wall, which causes it to pass to the under side of the pipes between which it returns to the back end of the boiler; by this means the heat is equalized on the coil and sufficiently retarded to secure full effect on the boiler. The feed-water enters the coil by pipe M and its connections under the same conditions as to heat,

place of the brick bridge wall, which is lowered to admit it, the water from the bottom of the boiler passing through the pipe N to the drum, where its temperature is raised much higher than that in the boiler to which it returns, nearly all steam, through the pipes G H. By this means the intense heat on the bridge drum is utilized, and a rapid and continuous circulation is maintained. The time and other impurities in the water cannot settle and form scale, but pass down into the drum, from which they do not return to the boiler, and are readily blown out through the pipe F or removed at the hand-hole E.

A PHENOMENAL Egg.—Mr. H. B. Churchill, of Weathersfield, Conn., has presented to the office of the *Field and River* an egg which that journal describes as measuring nine and one eighth inches in circumference the long way, and seven and three quarters the other way. It is probably the largest hen's egg ever seen. It weighed seven ounces. Inside of the shell was another perfect egg with ordinary shell—a very singular fact. The egg was laid by a white Cochins pullet of a last June's brood, and this was the third egg she ever laid.

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THE chief reasons why our patent business has grown up to such importance are that, united to a long experience in the business, we devote very careful attention to the study and preparation of our cases. In addition to this care and study, we do not abandon the interest of our clients after their applications are filed in the Patent Office. We have the advantage of the best service at Washington to look after all the requirements of the Commissioner.

WE publish in this number three Patent Lists. As there are fifty-two such lists published annually, it will happen four times in a year that such encroachment upon space for other matter will be necessitated. However, we hope to have compensated in quality of the general reading matter for its somewhat diminished quantity.

WITH this number we publish a valuable supplement—namely, a chromatic scale for use as a guide in tempering steel. A full explanation is printed on one side of the sheet.

AN IMPORTANT SALE OF A PATENT RIGHT for a system of underground telegraphy is stated to have been consummated in Philadelphia by Mr. David Brooks, the patentee, to the Western Union Telegraph Company, the consideration being \$250,000. The patent consists in insulating telegraph wires in cotton, laying the whole in a wrought-iron pipe filled with petroleum. This is done to protect the wires from the moisture of the ground. Experiments have been made with this system by the Pennsylvania Railroad Company, using it in its block signalling with marked success. The wires, encased in pipes, were laid in trenches beside the track. The purchase by the Western Union is for the patent right of the United States only.

The Keely Motor to the Front Again.

AMID the crowding innovations and astonishing discoveries of the last two years, the Keely motor had become almost forgotten. It was generally supposed, if we may be permitted to quote the lamented Jim Fisk, to have "gone where the woodbine twined." But this was a popular mistake. The Keely motor lives to perplex many, to excite a contemptuous curl on the lips of more, and perhaps to humbug a few. In the interest of the exploiters of this mechanical "What is it," it is to be hoped that the humbugged few may be flush with cash. In their own interest it is to be hoped that the humbugged few may be sufficiently flush with cash to spare the probable amounts which will be solicited for furthering the enterprise without materially feeling the expenditures. Then all will be serene. Then the yet-to-be-world-renowned motor will gain another term in its popularity, and those who wholly disbelieve may be made again to tremble for their scientific reputations by renewed reiterations of promise and warning.

"Wait and see!" This is what the believers say. "Wait and see," we re-echo "to all to whom these presents may come." As we understand it, while the patient, doubting public has been heretofore earnestly solicited to wait for the fulfilment of the Keely promise, it has been just as earnestly solicited not to wait in the matter of investing. But we advise the waiting policy in every thing connected with this Keely business, except in the fulfilment of the promises. This last provision we make all the more confidently, as we have been quite recently informed by the New York *World* and other influential journals that at last it is promised that the oft deferred promises made regarding this celebrated machine will be shortly fulfilled.

This last promise is the more promising because the hiding-place of the mysterious force so long elusive of the efforts put forth to trace it, has at length been found. It is "inter-molecular etheric substance," which either pervades all matter, or is made to pervade it by the Keely motor. The terms of the statement leave us somewhat in doubt whether the substance in question is constantly permeates matter, or whether the Keely motor manufactures it to order, as ice-cream freezers manufacture a delicious refective. It is said by the *World* correspondent that the machine produces this substance after having been treated (the machine, not the reporter, who might probably reject it) with a glass of water, and excited to put forth energy by the movement of a short lever. The word "produce" has an ambiguous meaning, from which we may either infer that the aforesaid inter-molecular etheric substance is a product of the machine, or that it is produced in the sense of being brought to light as a witness is said to produce documentary evidence in a court of law, etc. We incline to the former supposition, however, because, although molecular physics has been for a long time made a profound study by the most powerful intellects, any substance having the properties claimed by Mr. Keely to belong to his or the motor's inter-molecular etheric substance has not been by them discovered.

Here, then, is a machine that, so to speak, manufactures force to order, a machine which will soon be perfected, and which will be made the subject of a patent or patents. Here, then, is, in short, the Keely motor.

The "vibratory engine," too, is made, and the *World* correspondent says it runs, which is not incorrect. This is also very promising; but then the invention has been from its inception the most promising one ever announced to the American public. The single trouble has been that the promises have not been fulfilled. However, this state of affairs is, as we are now assured, past, and both the generator of the inter-molecular etheric substance and the vibratory engine are accomplished facts to be made public as soon as the patents are secured, and which happy consummation "even Tyndall and Edison" will be proud to own themselves convinced of the existence of the aforementioned substance with the complicated cognomen.

The *World* correspondent describes the vibratory engine as follows:

"Its main part consists of a steel disk about 30 inches in diameter, having a shaft passing through it. The disk is intended to revolve in a vertical plane. Projecting from the disk, at right angles to it and near its periphery, are a

series of 288 steel pins about one eighth of an inch in diameter, and varying in length from about five inches to two and one half inches, these pins being highly vibratory. This disk is surrounded with a cast-iron casing resting on a cast-iron bed-plate, underneath which are some other steel disks that are also highly vibratory. What functions are performed by the steel pins on the disk and the other acoustic adjusters, we have referred to, do not pretend to understand, and therefore give you Mr. Keely's own explanation. He says that their object is to intensify the vibration of his vapor and produce a rotary or vertical circle of vibration, which circle of vibration runs his engine, which he starts and stops at his pleasure. Since putting his engine together he has been busy—to use his own word—"focalizing" the machine. Attached to the engine is a hollow globe or sphere of brass about thirty inches in diameter. This globe is rotated by the disk of the engine at a speed say of 200 revolutions to the minute."

"These descriptions are necessarily general, and my explanations necessarily so vague, that I fear they may fail to give you any very definite idea of the processes described; but if the fact is made clear that Mr. Keely has a new and wonderful power which he appears thoroughly to understand and to control, engineers can await the revealing of his secrets until he has protected himself by letters patent."

It is very pleasant and really encouraging to be thus authoritatively assured that Mr. Keely at last appears to understand the invention or discovery he has made, and we are glad to see that the waiting policy we have advised in this article is also approved by the *World* correspondent.

Edison's Improvements in Electric Lights.

In another column we give an illustrated description of the recent inventions of Mr. Edison, whereby he expects to make practicable the subdivision of the light to any required extent.

It will be seen that one of the patents covers broadly the principle of thermostatic regulation of the strength of the current through a luminous coil, by the action of heat derived from the coil itself. The other patent covers a peculiar kind of lamp, in which the heat, or action of the heat is made to expand air or other fluid contained in an enclosure, which expansion acting upon a diaphragm and mechanism connected therewith, "short-circuits" the current or a portion of the same, thereby reducing the intensity of the current in the coil and permitting the latter to cool somewhat, or at least, not to become heated to any greater intensity.

The theory of these devices is sound. We apprehend, however, that the application of it will be found difficult, except in the hands of skilled electricians. The margin between white heat and the fusing point of even such a refractory metal as platinum is probably very narrow. The fusing point of platinum has not been accurately determined, but it will undoubtedly be found that to render the expansion air-chamber device effective will demand, as did the previous one, a very nice adjustment, and in this consideration which leads us, in the absence of any attempts to operate the device under the ordinary conditions which must attend its general introduction, to fear that the general run of the public will charge it to invention must ultimately be placed will not possess sufficient skill to use the light to advantage.

The departure from older devices is not so wide as from the originality of other of Mr. Edison's inventions the public was led to believe it would be. The expectation of the public was also much raised by the highly colored statements regarding the light put forth in advance of the publication of the later invention. There is no greater inventive genius displayed in this last regulator than has been exhibited in the improvements of more obscure inventors. This, however, will not detract from its value should it prove serviceable in general use, which we deem still problematical.

It was much to be hoped that Mr. Edison or some other inventor would succeed in overcoming the difficulties heretofore met with in attempts to render practicable the production of electric light by incandescent conductors. The light obtained from such a source is far superior to that produced from carbon points, as its intensity is not so great. It is, moreover, capable of subdivision to a far greater extent than is practicable with carbons.

We await with much interest an exhaustive trial of Mr. Edison's last regulator under such conditions of unskilled attendance and other circumstances which will prove or disprove its practical value, and we sincerely hope that such a test may show the fears we have expressed to be ill founded.

Destruction by Explosives.

At Stratford, Ontario, on the 5th inst., a car-load of dynamite exploded in the Grand Trunk freight yard, producing damage to the extent of (as has been reported) \$250,000.

The car in which the explosion occurred was freighted at Montreal for Amherstburg, and contained thirty packages, which were entered as blasting powder. They were shipped on account of Vanderbilt, to be used in blasting at the Detroit Tunnel. When the explosion occurred the cars were being shunted in the yard. The destruction was very widespread. The business part of the town, a mile distant, was severely damaged. The nature of the damage sustained at this distance is characteristic of all great explosions of nitro-glycerine or any of its modifications. Not only were panes of glass broken in windows, but large plate-glass windows were blown bodily out of their casements. Similar damage was sustained along the North River water-front in this city at the time of the great explosions in Bergen Tunnel, Jersey City, which will be recalled in this connection.

In view of the recurrence of such accidents, and the fact that the use of these powerful explosives annually increases, it is much to be desired that more extended knowledge of the causes of explosions should be gained, and that additional safeguards against them should be supplied.

Investigation conducted by a properly organized scientific commission ought to be instituted, and, if possible, modes of shipment which will preclude the repetition of these disasters should be adopted.

The shipment of such explosives in quantities, which, if an explosion occur, will destroy property to this extent, ought to be prohibited.

Facts pertaining to the Manufacture and Uses of Wire and Wire Rope, and Teldynamic Transmission.

NO. I.

THE uses of wire and wire rope extend annually. The manufacture of wire, and ropes made of wire, especially the manufacture of the latter, is a growing industry which may be said to have passed its infancy.

Believing that many facts of interest to our readers might be gathered from a visit to some large establishment devoted to these industries, we recently called at the office of a gentleman, Mr. J. B. Stone, C. E., at 31 John Street, New York, and, through his object, received a polite invitation from Mr. Haigh to visit his extensive works in South Brooklyn.

We were escorted to and through the works by Mr. J. B. Stone, C. E., a highly accomplished gentleman connected with the establishment in the capacity of consulting engineer. To this gentleman are referred all questions that arise which belong properly to the department of civil engineering, such as surveys for the erection of bridges and tramways, estimates of cost of construction, etc.

Arriving at the works we were introduced to the superintendent, Mr. C. S. Howell—a thoroughgoing, stirring, off-hand gentleman, evidently full master of his business—and to Mr. M. M. Zellers, supervising engineer, and the inventor and designer of the most important machinery used in the works, some of which is of the most intricate character, evincing in its construction mechanical skill and ingenuity of the highest order. Each of these gentlemen courteously assisted us in gathering the information we propose to lay before our readers, which is not so much for the purpose of describing the manufacture of wire and wire rope, or the well-organized establishment of Mr. Haigh, as to give valuable facts relating to the use of wire in various industries, and of wire rope in the transmission of power for driving machinery, drawing cars on tramways, hoisting weights, etc. Before we conclude, however, we shall again refer briefly to the works themselves, which are admirably organized and very efficiently supervised by the gentlemen we have named.

For much of the information we shall give we are indebted to a treatise entitled "The

Manufacture of Wire Rope, and its Use in Transmission of Power, Suspension Bridges, and Tramways," published by Mr. J. Lloyd Haigh, the proprietor of the works we visited, and written by Mr. Stone, the consulting engineer of the establishment, whom we have already mentioned. We here give a general credit to this treatise for all extracts which are indicated by quotation marks, and for many items of interest paraphrased therefrom and not so indicated:

"Wire rope may be said to owe its origin to the ravages of a rat's tooth."

"The first maker of wire rope was Andrew Smith, of London, and its use dates, in 1828, from the following incident: In the mechanism of his patent metallic shutter, there was required a very strong but small cord. The strength required being so great, and the space for its occupancy so small, nothing but catgut was found to answer. Their destruction by the rats led to the substitution of a cord made of twisted fine wire. Smith spent four years in observing the wear of these cords, and experimenting, making his first piece of wire rope in 1829, and patenting his rope machine in 1831."

"Its use on the Continent, however, must have antedated this a few years, as wire rope was used in the mines of the Harz Mountains in 1831."

"Its first use in this country was upon inclined planes upon railways, and on the Morris Canal."

"The evident superiority to hemp rope in strength, durability, and lightness, soon led to its extensive use. These points, in comparison, may be seen by reference to the following table, which is one originally compiled by Andrew Smith."

Hemp Rope.				Wire Rope.				Ultimate Strength.
Size.	Weight per Fathom.	Size.	Weight per Fathom.	Size.	Weight per Fathom.	Size.	Weight per Fathom.	
Inches.	Lbs.	Oz.	Inches.	Lbs.	Oz.	Tons.	Cwt.	
3	2		1 1/2	1	4	2	10	
4	2 1/2	15	1 3/4	1 1/2	4	9	20	10
5	3		2	1 3/4	1 1/2	14	20	15
6	3 1/2	0	2 1/4	2	5	8	0	
7	4		2 1/2	2 1/2	9	8	11	
8	4 1/2	0	2 3/4	3	5	4	15	6
9	5		3	3 1/2	5	4	15	6
10	5 1/2	0	3 1/2	4	11	6	29	5
11	6		4	4 1/2	15	12	35	4
12	6 1/2	0	4 1/2	5	15	12	35	4

"By comparison with the more recent tables, we see great improvement has been made in the manufacture of hemp rope."

"In wire rope, as his table does not state the character of the rope, we cannot compare so closely. Presuming it to be with solid centre, we see the strength to be about the same as that of the present day, which fact, taken in consideration with the irregular increase in strength as the sizes progress, leads to the conclusion that better material was then used than can now be had, but that the lay of the rope was not so uniform."

"The following table contains a list of the varieties of wire rope made, and the purposes they are usually applied to:"

No. of Strands.	No. of Wires.	Centre.	Form of Rope.	PURPOSE USED FOR.
3	2	Hemp	42	Hoisting, Transmission and Riggering
4	3	Wire	40	Standing Rope and Bridge Cables.
5	4	Hemp	36	Hoisting and Transmission
6	5	Wire	70	Hoisting, Transmission and Riggering
7	6	Hemp	114	Hoisting.
8	7	Wire	113	Hoisting.
9	8	Hemp	252	Hoisting and Steering.
10	9	Wire	254	Hoisting and Steering

"Rope Nos. 7 and 8 is made by using rope Nos. 1 and 2 as strands, and twisting six of these around a hemp centre, making a rope very strong and pliant."

"Fig. 1 shows the arrangement of the wires and hemp centre in rope No. 1, which is the one most used. The hemp centre is provided both for the greater degree of pliability it imparts to the rope, and because of the lessened wear upon the wire by abrasion in passing around a drum or sheave, the centre forming an elastic cushion between the strands."

"Rope of 10 wires to the strand is more pliable than rope of 7 wires to the strand, and hence better suited to hoisting where small drums are required; they are made both with solid and with hemp centres."

"Numbers 3 and 4 are seldom made."

"Wire rope, as manufactured by Mr. Haigh, may be of indefinite length without splicing of strands, as commonly practised by other manufacturers, the only joints being those of single wires at different points, and the joint being so made as to be stronger than the wire itself."

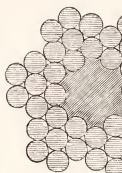


FIG. 1.

"Flat wire rope is also made in limited quantities for hoisting purposes in mines."

A peculiar characteristic of the wire rope manufactured by Mr. Haigh is that when straightened out upon a level surface it manifests no tendency to curl or kink, a point of superiority over other wire rope in market that greatly adds to its convenience in handling and use.

The twisting of strands of wire over a hemp centre not only renders the rope more flexible, but also increases its strength in proportion to weight, because when such a rope is put under tension it stretches longitudinally, compressing the hemp core, and insures the distribution of the stress to each wire in each strand, so that every wire supports its proper share of the strain.

In a succeeding article we shall supply other valuable facts which are needed to a proper comprehension of the principles of teldynamic transmission

Jackson's Improvements in Pattern-Making and Casting Metals.

NO. III.

HAVING described Mr. Jackson's system of pattern-making, we now proceed to the discussion of an improved method of casting patented by him, the application of which has enabled him to produce castings formerly considered impossible to make.

The cracking and warping of castings after the pouring of the metal into the moulds occurs from unequal contraction, which is due to inequalities in the rate of cooling. Parts of the castings are thus put either under tension or compression, compelling them to bend or break.

The gist of Mr. Jackson's invention is the adoption of means whereby uniformity in rate of cooling is enforced upon all parts of the casting or the cooling of different parts controlled at will.

The solidifying of a molten mass of metal is a process analogous to the freezing of water. There are, however, some differences. Among these may be mentioned the fact that, while congealed water is a very bad conductor of heat, and therefore, when a body of water has its surface frozen over, the heat escapes very slowly from the fluid portion beneath, solid metal is a very good conductor of heat, and also a good radiator, and consequently it not only loses its heat rapidly, but rapidly conducts heat away from the fluid portions. Notwithstanding the superior conducting and radiating power of metals, and notwithstanding that, in the ordinary method of casting the molten mass is surrounded by a bad conductor—namely, the sand of the mould—in foundry, as ordinarily conducted, there are always some portions of the metal which solidify first; and as after solidification the solid portions contract in cooling, while the fluid portions still remain expanded, warping, twisting, and, in many cases, the breaking of the castings in

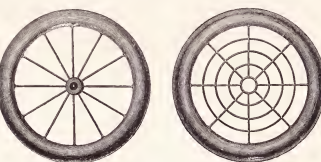
cooling result. Much skill has been required to obviate these difficulties, and they never have been fully obviated in the method hitherto employed. For instance, the castings shown in Figs. 8 and 9 would be felt quite safe in asserting, defy the skill of the most expert foundrymen using the ordinary method. In Fig. 8 is shown a wheel with a very heavy rim in proportion to the spokes, which are extremely light. In the same figure is also shown a wheel with a heavy cylindrical rim, cast without a hub with very light spokes, and these spokes connected with equally light rings of metal. In Fig. 9 are shown a solid sphere surrounded by a light web of metal, and a wheel with a solid rim and spherical hubs connected by a gossamer-like web. These castings were made by Mr. Jackson's method not only unbroken, but perfectly straight and true.

The practice of cooling the heavier portions of castings by artificial means, so that these parts shall become cool as soon as lighter parts, has been practised to a considerable extent. In Mr. Jackson's process this method is wholly reversed, his plan being to keep the lighter portions heated as nearly as possible to the same temperature as the heavier portions, that the cooling may proceed uniformly throughout, or may be controlled as desired. This new process is applicable to making castings of all refractory metals, and insures the production of sound castings, which otherwise, owing to the inequality of their different proportions, it would be very difficult, under the processes heretofore practised, to obtain. The equilibrium of temperature in the casting is obtained by means of molten metal run into or around the mould of the lightest parts of the castings to be produced, in order to keep the sand of the mould at such parts and during the cooling at equal temperatures with the heavier parts of the casting. In this way the unequal contraction of the different parts is avoided.

As we have already said, and as illustrative in Figs. 8 and 9, castings are produced in this manner which have hitherto been deemed impossible. The invention is particularly applicable to architectural and engineering work, much of which has hitherto been difficult to produce on account of the difficulties specified. Such a method does this method give over the production of castings that, by means of suitable arrangements, Mr. Jackson will cast a beam of the section shown in Fig. 10, either straight or curved, in either direction, as shown, using the same pattern for each beam. The curvature in the figure is slightly exaggerated, but is very marked in the beams from which the drawing was made. Specimens of these castings are now to be seen at Mr. Jackson's works, corner of Twenty-eighth Street and First Avenue, in this city. They were also shown at the Centennial Exhibition, where they attracted much attention from practical founders. They illustrate the value of the invention as well as anything that can be shown. Mr. Jackson has also at his works on exhibition specimens of square bars, ranging from a quarter of an inch up to two inches square, cast on a chill at the ends, and made from patterns of the same length, the bars, when cooled, being of uniform length and very straight. This also serves to illustrate the perfect control which the method gives the founder over the contraction of the metal in the moulds.

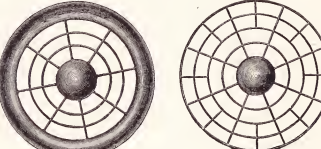
To illustrate further the application of the method, the form of a fly-wheel with a heavy rim and light spokes and heavy hub will be perhaps as good an example as we can take. Besides the ordinary patterns employed for

this purpose, auxiliary patterns, shaped to conform to the shape of the spaces between the spokes, are used, of a size sufficient to occupy the larger portion of each space, and of a thickness at the outer ends a little more than the width of the rim, increasing in thickness toward the centre, where they are about equal in thickness to the hub. With these patterns impressions are formed in the sand to receive the auxiliary metal with suitable gates leading



JACKSON'S IMPROVEMENTS IN PATTERN-MAKING AND CASTING METALS. FIG. 8.

to the hollows thus formed when the flask is closed. The mould having been thus prepared, the metal will be poured into these auxiliary spaces first, or simultaneously with the pouring of the other parts of the casting. The result is that the rim of the casting cools first, and contracts upon the still fluid metal of the spokes and hub, which, by the law of hydraulic pressure, expands in all directions. Hence the casting remains straight, and, when the interior portion



JACKSON'S IMPROVEMENTS IN PATTERN-MAKING AND CASTING METALS. FIG. 9.

becomes cool, is entirely without strain. We have seen many of rings formed in this way, and the absence of strain is indicated by the uniform duration of the musical vibration of any of their parts when tested by tapping with the hammer. If, on the contrary, the wheel were cast in the usual way, the spokes would cool first, and the rim and hub becoming solid after the spokes become rigid, the contraction of the rim would compress the spokes, and not only warp the casting, but submit the

ical hub and the heavy rim would rend them from the lighter portions. It is safe to say that these castings could not be produced by the ordinary method once in a thousand attempts.

The application of the method of pattern-making we have described, in connection with this method of producing perfect castings, enables patterns to be produced in metal more perfectly than has ever been done before. The pattern may be either so warped as to ensure the straightening of the casting while cooling, or the pattern may be made perfectly straight, and the straightening of the casting insured by the use of the auxiliary metal cast around or at the side. This is demonstrated by the diagram of the iron girders here shown, in which the casting is warped either way, or is cast straight as desired.

It is seen, then, that two very important elements of economy in the casting of metals are secured by Mr. Jackson's improvements: first, the patterns can be obtained more perfect and at much less cost than when made of wood in the ordinary manner; secondly, castings hitherto impossible may not only be made, but castings which have hitherto been considered as possible but difficult, and which give great trouble and cause much loss from their warping and contracting, may be made without any fear of such results.

Mr. Jackson has secured broad patents both for his improvements in pattern-making and in casting metals.

Self-Protecting Fire Service.

HOW SOME OF THE GREAT DOWNTOWN BUILDINGS ARE ARMED AGAINST THE FLAMES.—A STRUCTURE THAT IS SAFE IN ITSELF AFFORDS PROTECTION TO ITS NEIGHBORS.*

WITHIN recent years a number of extremely high buildings have been put up in this city, especially in the down-town portion, and a question that often suggests itself is whether, in case of fire, such buildings would be beyond the control of the firemen and their appliances. As yet, fortunately, there has been no serious fire in any of these great structures. To take a line of hose to an altitude of over one hundred feet—the average height of these modern structures—is an undertaking involving time and difficulty, besides the risk there is of the rubber hose, when carried over the edge of the roof, being cut or broken by the sharp zinc cornices peculiar to these buildings. To send a column of water from the street level over the top of one of these buildings is entirely out of the question, and for these considerations it became necessary to devise some means of providing auxiliary fire service within the buildings themselves to aid the Fire Department in serious emergencies. The best of these great structures are now furnished with tanks, fire pumps, and iron pipes, ascending from basement to roof, with valves for hose connections on every story.

HOW THE BENNETT BUILDING IS PROTECTED.

The high and massive iron structure in Nassau Street, between Fulton and Ann Streets, known as the Bennett Building, has, perhaps, the most complete fire service of any in the city. This service gives protection not alone to the building itself but to every building in its immediate vicinity. This fact was well illustrated on the afternoon of November 25th, 1875, when a fire broke out in the Fowler Building, at the south-east corner of Nassau and Ann



JACKSON'S IMPROVEMENTS IN PATTERN-MAKING AND CASTING METALS. FIG. 10.

spokes to great strain. In the ordinary way of casting such forms as are typified in Fig. 8 the lighter portions would be crushed together by the contraction of the heavy rim after the light portions had become solid and rigid. The interior would therefore be broken, or would be forced out of position. On the contrary, in casting such forms as are shown in Fig. 9 the light portion having first become solid and rigid, the subsequent contraction of the spher-

* New York Herald, April 29th, 1879.

Streets. Before the steam fire engines received the alarm, which was promptly given by the police, Captain John L. Knight, janitor of the Bennett Building, ran a line of hose from the large Woodward pump in the building across Nassau Street and extinguished the fire in John A. Dougan's hat store on the first floor of the burning house. December 11th, 1878, a fire broke out in the same place. On this occasion the fire service in the Bennett Building was put at the disposal of the Fire Department by the janitor. Two streams of water were turned upon the flames from the fourth story, and one from the roof, materially aiding to extinguish the conflagration. The apparatus in the Bennett Building is capable of commanding a blaze in any house opposite it, in Ann, Nassau, or Fulton Streets, and in any house in its rear between Fulton and Ann Streets. As few people know anything about the system referred to, a description may prove of interest. On the Nassau Street front of the Bennett Building, and at a distance of fifty feet apart, are to be seen two iron pipes, two and a half inches in diameter, rising from the sidewalk to the roof and standing out some little distance from the wall of the building. At each story two short branch pipes project from the main pipe and have valves to receive hose connections. The first of these valves is down by the sidewalk and ever ready to receive the hose of the Fire Department. Now, in place of the latter being compelled to carry their hose to the roof of the building—a thing they might find it impossible to do—they have simply to attach it to one of these valves near the sidewalk, let their engine play, and a column of water shoots to the roof through the iron pipe. The pipe goes down below the sidewalk seventeen feet, and above it too feet. In the basement it terminates in a valve to which at any time a hose can be attached and carried to the pumps, less than a hundred feet away. On Fulton Street, springing from the sidewalk to the roof, another of these pipes may be observed, and still another in Ann Street, while a fifth, completing the circuit of the building, is to be found in the rear behind the Belmont Hotel. Except the pipes on Nassau Street, which have two valves, the others have one at each story.

NO PRECAUTION OVERLOOKED.

At the roof the pipe rising straight into the air bends at a right angle and passes horizontally over the cornice, resting secure on an iron trestle. A cap is on the valve, the thread of which is kept constantly oiled, and a spanner hangs by the pipe, so that no delay will occur in attaching the hose. Lying along the roof are two lines of hose, each 100 feet in length. The janitor explains that the hose is thus stretched out so that the air can blow through it and keep it always in perfect order. When hose is coiled up it stiffens and cracks, and when not much used becomes defective. Inside the building, along the centre corridors and near the ceiling, resting on a shelf, is a length of hose for each floor. A fork is at hand to take it down, and a spanner to connect it with the valve within the wall of the building—an operation that may be performed in a minute and a half. All fire pipes terminate in the basement, where there are half a dozen lengths of hose and half a dozen pumps ready for any emergency. The capacity for flooding the building through all these agencies is immensely enhanced, and in this respect gives this building an advantage over every other in the city by the fact that there is a twenty-inch main outside in Nassau Street, connected with the basement by a six-inch pipe. It is easy to see what an enormous command of water a main of such dimensions must have. But other equally large buildings have to draw their supplies from four and six-inch mains. In case the pumps should be out of order there are independent pipes connecting with the twenty-inch main, and by the simple turn of a screw the basement may be flooded in a few minutes.

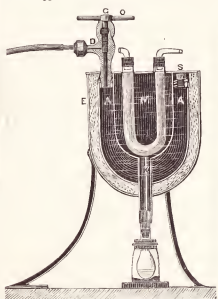
A BOUNDLESS SUPPLY OF WATER.

It was only very recently that this twenty-inch main was tapped, which was done by having a heavy cast iron pipe bolted on it. A nipple, six inches in diameter, was then connected to a six-inch stopcock in the street and a short piece of iron pipe run from the stopcock to the inside of the vault wall. From the vault wall a six-inch wrought iron pipe, fifty-six feet in length, was run to the tank supplying the fire pump, and a gate valve was placed near the tank to control the flow of water. Two branches from the six-inch pipe were constructed, so that the first and basement stories, as

well as the vaults and fire-rooms, may be flooded when required. In case of severe frosty weather, when the street hydrants are apt to be frozen up, the hydrant inside the building cannot possibly freeze, but is at all times and seasons able to supply three streams of water two and a half inches in diameter. Other buildings have fire hydrants inside of them; but, as they tap water mains of very small diameter, they can never be sure, especially in winter, of an adequate supply of water. With its present exhaustless and abundant water supply, and its disposition of pipes, valves, and hose, the Bennett Building might cope successfully with a fire raging across the streets all around its three sides, while it completely commands the Belmont Hotel in its rear. A man is on duty day and night, and particular pains are taken to see that the valve threads are oiled and the spanners and washers for making the hose connections are where they ought to be and the hose itself ready for instant use.

New Method of Producing Cold.

In our last issue will be found a short article describing the production in large quantities of chloride of methyl from residues of beetroot molasses. By reference to that article it will be seen that very intense degrees of cold may be obtained from the evaporation of this remarkable substance. When the tap of a reservoir in which it is contained is gently opened the liquid immediately rushes out, and may be received in an open vessel. It at once enters into a state of ebullition, which lasts for a few moments; the surface then becomes calm, and we have about of about 23°C . If the evaporation be accelerated by the simple injection of dry air the temperature may be reduced to about -55° .



M. Vincent has devised a simple and inexpensive apparatus with which this uncongealable bath may be maintained during several hours. It consists essentially of two copper cylinders, A, one inside the other, between which the liquid chloride of methyl is introduced through the valve B, formed of a rod of grooved steel, C, which terminates in a cone fitting over the base, which is of bronze, the whole being worked by the handle D. On the opposite side of the apparatus a screw, S, which presses on to a pellet of lead, being slightly unscrewed, allows the escape of air when the chloride is introduced into the vessel. Isolation from the warmth of the surrounding atmosphere is secured by a non-conducting material, the whole being supported on a tripod. The tube K, which traverses the lower part of all the envelopes, allows in certain experiments a tube to project from the central chamber to draw off products which have been condensed in the U tube, as shown in the figure.

To work the apparatus it is only necessary to charge it with the chloride, cork up the lower end of the vertical tube K, and pour alcohol into the bath M. On unscrewing the valve the chloride immediately begins to boil, the violence of the ebullition being in proportion to the temperature of the apparatus, or as the valve is more or less opened. As the jet of gas diminishes in force the valve is gradually opened wider, and after a few moments the

gas issues but very feebly. The temperature of the bath of alcohol rapidly falls to about -23° , and the valve being left open this is maintained as long as any chloride remains in the apparatus, thus enabling the refrigeration during several hours of any thing which is plunged into the bath. When it is desirable to terminate or suspend the operation it is simply necessary to close the valve, and if any chloride remains in the apparatus it is always in readiness for another experiment. Operations at a temperature lower than -23° can be effected by stimulating the evaporation of the chloride by connecting the valve of the apparatus with an air-pump and exhaustor.

Sandford's Screw Hoisting Machine.

THIS is a striking innovation in hoisting gear, combining, as it does, in most compact form, the principles of the pulley, flexible driving belt, worm gear, and tackle block. The latter, however, may be omitted, as shown in Fig. 1, when it is desired to do so. Where great hoisting power is required, however, the additional sheave shown in Fig. 3 will be found desirable.



FIG. 1.

The links of the hoisting chain are flat and are provided on their outer parts with inclined teeth fitting the screw on the shaft of the driving pulley, in the groove of which runs an endless chain belt.

The hoisting chain has a hook at each end. This arrangement saves much time, as when the load is hoisted the chain is in position to hoist another load. The apparatus works smoothly and easily, and the load when hoisted will not run back. This is a great advantage.

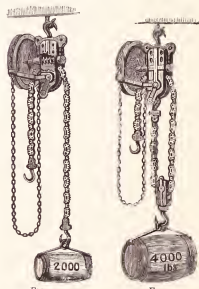


FIG. 2.

FIG. 3.

A comparison of Fig. 2 with Fig. 3 shows how a 2000-lb. hoisting machine of 2000 lbs. is converted into one of 4000 lbs. by the simple addition of a running block or sheave and the doubling of the hoisting chain. This invention is a really good one, and we believe it will have a brilliant future.

The machinery is by Mr. S. Park Lathrop, No. 200 Market Street, Newark, N. J.

Edison's Improvements in Electric Lights.

COPIES of these patents came to hand just after we had gone to press with our last issue. We herewith give diagrams and a description prepared from the patents which amply illustrate the invention.

The title of one of the patents is "An Improvement in Electric Lights." The patent bears date October 14th, 1878. There are two claims in this patent:

1. In combination with an electric light having a continuous incandescent conductor, a thermostatic circuit-regulator, substantially as set forth.

2. In combination with an electric light, a thermostatically-operated shunt, substantially as set forth.

In the specification of this patent, which is designed to cover as far as possible the use of a thermostatic regulator operating to short-circuit the current when the intensity of the heat becomes too severe, Mr. Edison says:

"Various devices for carrying my improvement into practice may be employed, and I have tested a large number. I however have shown in the drawings my improvement in a convenient form, and contemplate obtaining separate patents hereafter for other and various details of construction, and I state my present invention to relate, broadly, to the combination, with an electric light produced by incandescence, of an automatic thermal regulator for the electric current."

The second patent to which we shall allude is for the device which has recently been asserted to overcome certain difficulties which were found in practice to exist with the particular one shown and described in the patent of October 14th, 1878, as an illustration of the invention.

The date of the patent for the alleged successful device is April 22nd, 1879.

We will describe these devices in the order of their invention. Figure 1 represents the electric light apparatus in the form in which the thermal regulator acts by the heating effect of the current upon the coil itself, which, if current report is to be trusted, Mr. Edison has himself admitted to be defective in its operation.

The incandescent metal is to be platinum, rhodium, iridium, titanium, or any other suitable conductor having a high fusing-point, and is used in the form of a wire or thin plate or leaf.

The platinum wire *a* is a double spiral, the two ends terminating upon the posts *b*, *c*, to which the conductors *d* *e* are connected. The double spiral *a* is free to expand or contract by the heat, as both ends are below the spiral.

A circuit-closing lever, *f*, is introduced in the electric circuit, the points of contact being at *i*, and there is a platinum or similar wire, *h*, connected from the lever *f*, to the head-piece or other support *l*.

The current from the source of electric energy is connected to the binding-posts *u*, and when contact at *i* is broken, the current passes from *u* through lever *f*, wire *h*, support *l*, wire *e*, post *c*, platinum coil *a*, post *b*, and wire *d*, or metallic connection, to binding-screw *n*. In this instance the wire *h*, being small, is acted upon by the electric current and heated, and by its expansion the lever *f* is allowed to close upon *i* and short-circuit the current.

The contact-point *i* is movable, and it is adjusted so that the shunt will not be closed until the temperature of the apparatus arrives at the desired height.

By diverting the whole or a portion of the current in this manner it was expected that the temperature of the incandescent and luminous coil would be kept below the fusing point.

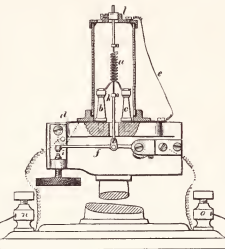
Fig. 2 illustrates the device patented April 22nd, 1879.

The invention consists in causing the heat generated by the incandescent conductor to expand air in a containing-chamber as its temperature rises, the pressure thus created serving to move outwardly a yielding material—such as a diaphragm—which, in its turn, serves to control the passage of the electric current through the incandescent body by means of contact-points or circuit-regulators, and thus automatically regulate the temperature of the incandescent conductor.

The glass vessel or tube *a* contains a spiral or strip *c*, of iridium or equivalent metal, through which the current passes; *d* is the top plate, to which the spiral *c* is connected. The glass tube is secured to the metallic

standard *Q*. *e* is a diaphragm closing the bottom of the lower chamber. There is a partition between the chamber containing the spiral *c* and the chamber of the diaphragm; but air circulates freely between the chambers through the holes *d* *d* *d*.

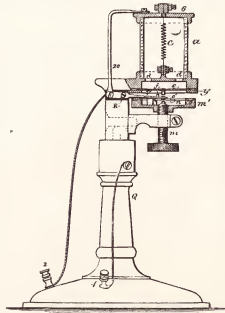
When the spiral is heated by the passage of the current, the air in the chambers expands and bulges the diaphragm outwardly. On the centre of the diaphragm is a platinum point, *f*, immediately opposite another platinum point, *g*, on a spring, *h*. This again is opposite another platinum point, *n*, on the screw *m*. *m* is a disk of insulating material, on the top of which is a brass ring in electrical connection



with the spring *h*. A rubbing contact-spring, *v*, connects this spring to the insulated plate *R* and the binding-post *z* on the base. The frame *Q* is connected to the other binding-post, *1*. A wire, *20*, connects the spiral of the light with the plate *R* and binding-post *2*.

When no current passes in the circuit containing this instrument, the air in the chamber is of the same pressure as the atmosphere, and the points *f* and *g* and *n* are not in contact. If, now, the current is allowed to circulate in the line, it passes, say, from the binding-post *2* to *R*, thence through wire *20* to the top *h*, down through spiral *c* to base *Q*, to the other binding-post, *1*.

When the spiral *c* reaches within a few degrees of its melting-point, the expansion of the air will have bulged out the diaphragm *e*, and brought the points *f* and *g* together, thus short-circuiting the current from the spiral, as it now must nearly all pass from binding-post *2* to *R*, thence through spring *v* to the ring *y*, through



spring *h* to *g*, through *f* to diaphragm *e*, to *Q*, and back to binding-post *1*. When this short-circuited the temperature of both the air and spiral fall by radiation, and when it reaches a certain point the diaphragm and point *f* leave *g*, and the current again passes through *c* and raises its temperature, and the same action takes place. This regulation is so rapid that the eye does not perceive any diminution in

the strength of the light. The object of the contact between *c* and *g* is to cause *f* and *g* should fail to make contact the short circuit would still take place, as *n* and *f* are both connected to *Q*.

Mr. Edison describes in the specification of this patent different modifications of the device, but the general principle of each is the same. He claims the method specified of regulating the temperature of the incandescent light-giving body, by the expansion of the air or gas in the closed vessel containing the light, acting automatically in the electric circuit, substantially as set forth.

Some comments upon these inventions will be found in our editorial columns.

The Mutual Relations of Capital and Labor.

A PAPER READ AT THE CHURCH CONGRESS IN CINCINNATI, OCTOBER 15, 1878, BY HON. ABRAHAM S. HEWITT.

NO. III. WEALTH AND CAPITAL.

WHAT are these demands, and how far are they just? In order to answer this question we must penetrate a little deeper into the true nature of what is called the conflict between capital and labor, and we must define what we mean by capital. All wealth is not capital. So far as this discussion is concerned, and so far as regards the conflict of which we are speaking, capital may be defined to be that portion of the wealth of society which is employed in the work of production and distribution. Outside of this portion of human wealth there is a vast fund which is otherwise employed—in ministering to the wants, the luxuries, the tastes, the charities of mankind. Now, when a strife takes place it is in fact a contest between the laborers, and not labor, on the one hand, and the employer, and not capital, upon the other hand. In fact the employer is not always, nor indeed in the majority of cases, the owner of the capital which he uses. Sometimes he owns none of it. It may be all borrowed; and as a matter of fact, some of it, to the extent of the current wages due and unpaid, is always borrowed from the very men who he employs. No conflict, therefore, between capital and labor ever really takes place, nor indeed is it possible for it to occur. Between the individual who labors and the fruits of his labor there can be in the nature of things no conflict. The very object of his labor is to acquire these fruits, which we call capital, and the possession of this capital is necessary for increasing the productivity of his labor. This is the case of any one man it is true of all the men who make up society. Therefore, whether the individual or society be considered, there is no antagonism and there can be no conflict between capital and labor. The utmost that can happen is that they each cease to earn anything. Great suffering always results to the laborers, and very often ruin to the employer; and yet, so far as labor and capital are concerned, while they are paralyzed for the time being, they are not capable of rendering any thing to each other but benefit. Still there is a conflict going on—a conflict which the employer, as a rule, is powerless to mitigate, an which may ruin him, although he be the owner of no capital. In other words the employer is often the victim of circumstances over which he has no control, and of an antagonism which he rarely understands.

What is it that labor really aims to accomplish? It is to transfer to itself a larger portion of the proceeds of the business. If it succeeds, this portion must be taken either from the capital itself or from the profits of the business which have heretofore been appropriated to capital. It cannot be taken from the capital without either impairing the ability of the employer to pay wages or compelling him to suspend business altogether in which event labor fails utterly to attain its object. If, therefore, a concession is made by the employer which impairs the capital and he continues business, the impairment must be filled up from some outside source, and that source can only be that portion of human wealth which was not previously employed in the work of production and distribution. If, on the other hand, the demand of labor is met out of the profits, then the amount conceded is taken from that portion which would have been transferred from capital to this outside fund. In either case, therefore, the result is to withdraw a portion of

the outside fund not in use as capital and transfer it to labor. The conflict, then, is a struggle for the ownership, not of active capital, but of that portion of the wealth of society which is used for other than productive purposes. In its essence, therefore, the conflict is between riches and poverty, and is an attempt to change the existing ownership of wealth.

RICHES AND POVERTY.

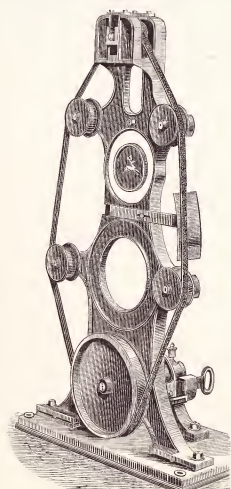
We are thus brought face to face with the great underlying question whether property is equitably distributed. What are the facts? We find society practically divided into four classes. First, the very rich, who live without labor upon the proceeds of realized property, with superabundant means which they are free to employ either as capital in business or to minister to their own desires, whether commendable or censurable. Second, the great middle class, who know neither poverty nor great riches, who are as a rule engaged in useful employments, who have more or less of the comforts and luxuries of life, and who are above the reach of want. Third, the industrious working classes, who possess little property, but who gain a decent livelihood for themselves and their families by their daily labor. They may be said to be in the sense that they are liable to be reduced to want by sickness or by the chances and changes of business depriving them of the opportunity to work. Fourth, the paupers, who have no other care to work. If the first and fourth classes should cease to exist, humanity would not have cause to shed many tears. The problem, then, which society finds itself forced to solve, is engaged in solving the problem of getting rid of these two extreme classes without revolution and without injustice. The relations of the second and third classes would be readily adjusted, because the transition from one to the other is not only easy, but very constant. The ties between them are often the ties of family. Their interests are identical, and their relations to each other are such as can be and are substantially regulated by the principles of justice. As between them it is scarcely necessary to discuss the limitations of wealth. But when we come to consider the position of the very rich we are met by the self-evident fact that they possess and control an amount of property which is far beyond the capacity of any class of human beings of their limited number to contribute by their own efforts to the sum total of human wealth. In fact the present possessors have rarely accumulated the fortunes which they control. The possession of superfluous riches will not stand the test of human justice; and in affirming this I only repeat the conclusions to which the greatest thinkers and the best men who have ever lived have invariably been driven. But even if it were not reinforced by such authority, it is in accordance with the whole spirit and temper of the teachings of Christ himself. He nowhere condemns the ownership of property. On the contrary, when he tells us that the poor we shall have always with us, he expressly recognizes that there will be inequalities in the ownership of property. He states it as a fact. But he nowhere says that we shall always have the rich with us, and the spiritual danger of great riches is repeatedly enforced. I use the word "rich" as the Saviour used it—in the sense of the possession of superfluous wealth. I do not pretend to say what is superfluous. It is not necessary for this discussion, nor do I think it will ever come within the province of legislation to decide that question. I think it will be settled by the action of causes now in operation, by which a larger portion of the accumulated wealth of society will be transferred from the class of the very rich to the class of the industrious poor, and that the struggle which we call the conflict of capital and labor will slowly and surely effect this transfer by the gradual growth of a better understanding between employers and employed, out of which will gradually come a different ownership of capital from that which now obtains.

CHANGE OF OWNERSHIP.

How can this change of ownership be effected? Already the employers and employed meet upon the equal ground of open discussion. Already the endeavor to persuade each other to conciliate opposing interests. Failing in this, they arbitrate, and, in order that the arbitration may be binding, they are at length produce their books of account and submit their ability to pay to the decision of a fair tribunal. On the other hand, the workmen are free to proclaim their grievances and

to assert their rights. They submit them to the arbitration of reason; they accept the award of the tribunal, and it is to their everlasting honor that in no single instance have they ever refused to abide by the award. Having got upon the common ground of free and open discussion, it is not a difficult step to reach the ground of joint ownership. As business is now organized the workmen do not participate directly in the profits, but they have a first lien upon the profits; in other words, they must be paid before any surplus remains for capital. If they desire to participate directly this prior lien must be given up, and its abandonment will demand far greater intelligence on the part of the workmen than they have yet displayed. But they are rapidly advancing in all the qualities which go to form the basis of intelligent action. Better education and larger privileges in the exercise of the elective franchise, and the acquisition of political knowledge and sound economic principles through the agency of night colleges, mechanics' institutes and working-men's clubs, will soon prepare the way which will lead them to make the temporary sacrifice required to effect the great change in their social status which must inevitably attend the ownership of capital.

I shall be told (and I fully appreciate the force of the objection) that there are great difficulties in the way of associating employees in the ownership of the business in which they labor. So long as human industry is mainly controlled by individuals or firms composed of individuals, and so long as the laws impose individual liability upon all the partners for the acts of any partner, it will be impossible to associate a miscellaneous mass of workmen in the ownership of the business. But in England the old legislation has been entirely reformed, with the view to admit of such joint ownership upon almost any terms that may be agreed upon. In this country we need additional legislation, but in both countries there is one fact which points the way to an easy solution of the whole question, and that fact is the enormous growth of corporations for the conduct of industrial enterprises.



English Emery Band Polishing Machine.

This machine, which is designed to perform all sorts of emery polishing for which an emery wheel is not suitable, on account of irregularities in the work which render parts inaccessible

to a wheel, has been recently placed in the English market by Slack's Emery Wheel and Machine Co., of Manchester, England. It consists chiefly of a standard provided with bearings, carrying a driven pulley, over which runs an emery band, which is also carried by five loose rollers, the upper one of which is supported in a movable bearing acted upon by spiral springs to keep the belt tight. The bands used are endless, and usually of leather covered with emery of a number suitable to the work to be done. Some bands are of tape specially prepared for the purpose. The bands may be prepared by cementing the emery to the bands, tapes, or cords with glue in the ordinary manner. The machine seems very well designed for the purpose.

RATS AND WATER-CASKS AT SEA.—Mr. E. J. A'Court Smith, of the ship Cornwall, East Indian, Captain Cow, writes to *Nature* the following account of the desperate efforts of rats to assuage their thirst on board that vessel: "In 1849, in a voyage from Sydney, *viâ* Madras, to London, about three weeks after leaving the latter, it was found that a number of water-butts, in which the sailors had been drinking, were leaking. On examining them we ascertained that as many as ten or twelve butts had been perforated by rats; three or four were entirely empty from the leakage so caused, while the remainder contained sillages from about a half to a few gallons. In every case the stave had been eaten through just above the chime hoop, and those which had been apparently most recently operated on had only been perforated so as to cause a slight weeping, while the empty ones showed an opening as large as an ordinary vent-peg hole. The rest of the voyage a tub placed in the square of the main hatchway was kept constantly supplied with water, besides one or more square tins of water on the main deck.

"In the above voyage we stayed a week at Madras, and in losing the foretop-gallant-sail on leaving, a rat and five or six young ones fell to the deck; and the sail was found to be so much eaten and full of holes, made to form and line the nest, that the sail had to be un-bent and replaced."

AN ALLEGED CURE FOR HYDROPHOBIA.—A correspondent, writing from Paris, states that a well-attested cure for hydrophobia is just now occupying some attention in the medical world. The discovery is due to the experiment of two Russian physicians, Drs. Schmidt and Ledebur. A little girl aged 12 was bitten on the hand by a mad dog. The wound, after being cauterized, healed in a few days, but a fortnight after the accident symptoms of hydrophobia set in. The physicians thereupon made the little patient inhale three cubic feet of oxygen! By this means, in the course of an hour and a half, all the symptoms disappeared, and the child remained calm. On the next day but one the malady returned in all its distressing characteristics, difficulty in breathing and swallowing, and tonic convulsions. A fresh inhalation of oxygen was tried, and at the end of 45 minutes the attack subsided, never to return.

ANOTHER INNOVATION IN BELTING.—The *St. Louis Miller* says a firm that in city manufactures a belting tanned on the surface only; the interior, which is the fibre and strength of the hide, is not tanned, but raw-hide filled and softened. It is said the belting will transmit twenty per cent more power, and will last longer, than any other now made, and that it works equally well for the largest driving belts or for the fastest running machinery and smallest pulleys.

EDISON'S NEW LOUD-SPEAKING TELEPHONE was recently exhibited at a meeting of the Royal Society, London, the wires being carried from the Royal Institution to Burlington House. Professor Tyndal was at one end, and Professor Huxley at the other. Much amusement was afforded to a distinguished company. The telephone made itself heard over the whole of a large room.

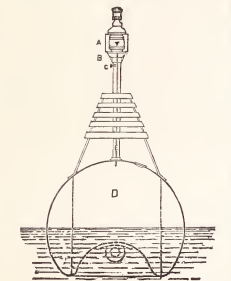
The Pintsch Patent Light Buoy.*

We give in our illustration the sketch of this buoy, which has been designed by the Trinity House Engineer (Herbert's system). A shows the lantern; B, the regulator; C, the valve to let the gas into the buoy; D, the reservoir; E, the supply pipe, leading from the reservoir to the regulator. The compressed gas used is dis-

* *New York Maritime Register.*

titled from fat or petroleum refuse, and gives a most brilliant light. The supply of gas is controlled by a delicate regulator, *B*, the mechanism of which is not affected by the movement of the waves, and is conducted through a small pipe to the burner in *A*. The gas consumed is only about six tenths cubic foot per hour.

The success of the buoy has been astonishing, and some have been constructed for the Russian and German Navy Departments. The Trinity House, London, made a very severe trial with the model light buoy, which was used at the mouth of the Thames for 28 consecutive days, in October last, during very boisterous weather. It showed a bright light day and night with such effect that it was distinctly visible at a distance of over four miles, from the deck of a vessel. This buoy, it should be remembered, was intended only as a model, and it was never contemplated to put it to the severe trials it has undergone, but so satisfied is the Trinity Board with its performance that they are now having two large buoys constructed for their use, which



are to be of sufficient capacity to carry a charge of compressed gas sufficient to supply a bright light for a period of six months continuously without refilling. The following is a copy of the Trinity House testimonial to Mr. Pintsch:—

TRINITY HOUSE, LONDON, E.C.,
10th December, 1878.

Sir:—In reply to your application for our expression of opinion on the Model Gas Buoy submitted by you to this corporation for trial, I am directed to acquaint you that the buoy has been tried in an exposed position at the mouth of the Thames, and that the Elder Brethren are so far satisfied with its performance in what relates to its illumination, that they have ordered the buoys to be constructed of a form suitable for their service, lighted with gas upon your principle, which, I am, sir, your obedient servant,

ROBIN ALLEN.

To the Manager Pintsch Patent Lighting Co.

We hear that if Secretary Sherman will allow a model buoy to pass duty free, and the Lighthouse Board will take care that the locks which protect the admittance to the interior shall not be tampered with, the company will send one to this country at once.

The practical sense of our Lighthouse Board has been shown in regard to his invention, as it has made inquiries whether the Pintsch light could not be used in connection with Courtney's whistle buoy, and the answer is in the affirmative. It will naturally take some time before a model of Pintsch's Courtney system can be finished, but there is ample time to make one before next autumn. The combination will certainly be for the benefit of navigation and the Treasury. The cost of maintaining the light is very small, being but six cents in twenty-four hours for buoys which burn one gas jet.

The introduction of this buoy for our lakes and rivers will only be a question of time, and will save the country large amounts of money by stopping the further construction of expensive lighthouses and beacons, and make steamboat travelling at night quite safe.

This system of gas buoys is only one of many applications of compressed gas as carried out by the Pintsch's Patent Gas Lighting Co.,

represented in this country by Mr. Ernst Schönröck, P. O. Box 3744, New York City. Under this system railway trains, horse cars, steamers, ferries, buoys, and the like, are effectually and safely supplied with gaslight. Mr. Schönröck assures us that it is quite possible to extend the system to ocean steamers. The system was awarded the Great Gold Medal at Moscow in 1872, the Progress Medal at Vienna in 1873, a gold medal at St. Petersburg in 1875, and the Society of Arts Gold Medal at London in 1877.

The system is also well adapted to lighting suburban residences, factories, etc., within easy reach of any gas-works. The delivery of the compressed gas to the burners is governed by a regulator.

Book Notices.

INDUSTRIAL SCIENCE DRAWING. Drafting Instruments and Operations. In Four Divisions. Division I. Instruments and Materials. Division II. Fundamental Operations. Division III. Plane Problems and Practical Exercises. Division IV. Elements of Taste in Geometrical Drawing. A Text Book for Schools and Artisan's Classes; and for Self-Instruction. Thoroughly Revised, with Additions. By S. EDWARD WARREN, B.A., former Professor in the Rensselaer Polytechnic Inst., Mass. Inst. of Technology, and Boston Art School. Author of a Complete Series of Text Books on Descriptive Geometry and Instrumental Drawing. Second Edition Revised and Enlarged with New Plates and Numerous Woodcuts. New York: John Wiley & Sons, 15 Astor Place, 1879.

Prof. Warren has long held a foremost rank in this country as an instructor. His experience has admirably fitted him for the preparation of such a work as this, and the book upon even a cursory examination gives ample evidence of his skill. The difficulties which meet the student of industrial science drawing have been often encountered in his classes that he is able in this book to foresee them all and guide the reader into the best path for surmounting them. Open where we may, we find at once the indications of experience with inexperience, and the plain, concise, and lucid method of a thoroughly trained teacher, master of his subject. We shall attempt no review of the book; but shall express our estimate of its merits by saying that were we to select a text-book for an ordinary class in the rudiments of industrial drawing, we should adopt this in preference to any other that we know.

SEWER GASES, their Nature and Origin, and How to Protect Our Dwellings. By Adolfo de Varona, A.M., LL.B., M.D., etc. Brooklyn Eagle Book Printing Department, 1879.

This is a small treatise prepared from lectures on sanitary science delivered by the author before various medical societies and colleges. The topics treated are: Necessity of Sanitary Measures; Composition of Sewer Gases; Relation of Sewer Gases to Disease; Sewers; Sanitation of Sewers; Sanitation of Sewers; Material of Sewers; Construction of Sewers; Ventilation of Sewers; and House Drains. These topics are discussed in Part I of the work. In Part II are discussed: Importance of Subsoil Drainage; Relations between Ground Water and Disease; The Isolation of Buildings; Other Protective Measures; Ventilation of Dwellings; and Disinfection. The book is very handsomely printed in bold type upon cream laid paper, and is illustrated by many well-executed woodcuts. It is a reliable handy volume of sanitary science.

THE "SPICE-MILL" COMPANION. A Collection of Valuable Information, Original and Selected. Suited to the Requirements of the Coffee and Spice-Mill Business, as Relates to Buying and Selling Stock, Manufacturing, Grinding, Mixing, and the Preparation of all Spices, Cleaning Coffee, and Glazing, and the Preparation of Goods in General, with Directions for the Running and Management of all Necessary Machinery. Also a Compendium of Valuable Receipts, with many Historic and Curious Facts in Relation to Coffee and Spices from their Earliest Introduction to the Present Time. By Jabez Burns, Editor of the *Spice-Mill*. New York: J. W. Pratt, Printer, 73 to 79 Fulton Street, 1879.

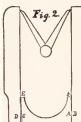
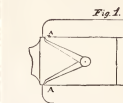
This is the somewhat extensive title of a very small but at the same time valuable book for all engaged in the trade of coffee and spices. It is primarily for the subscribers of the trade publication called *The Spice Mill*, but we presume it may also be obtained of the author, at his place of business, No. 99 Hudson Street, New York.

PARIS UNIVERSAL EXPOSITION, MDCCCLXXXVIII. Official Catalogue of the United States Exhibitors. Compiled by Thomas R. Pickering, and published by Direction of the Commissioner-General. London: Printed at the Chiswick Press. MDCCCLXXXVIII. Price Two Francs.

The nature of this book is sufficiently set forth in its title. It is an elegant specimen of printing and typography.

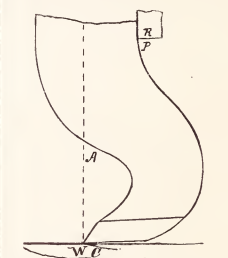
Shop and House Hints.

To Fit Brasses to Straps.—Let the strap overlap the rod end, as at A, Fig. 1; set the callipers

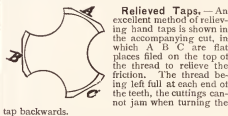


to just touch the strap jaws as shown. File the brasses until when driven home the callipers fit the strap applied as in Fig. 2. In driving the brasses in and out to fit, strike light blows first on E, then on F, and see if the brass moves equally on each side; otherwise one face, as A, B, may fit, and the other, as C, D, may not, hence G will not bed fairly on H.

Planer Tools.—A planer tool will cut much smoother and more true if it is forged back so that its cutting edge stands in a line with the body of the steel as shown at A in the accompanying illustration, because the point B at the end of the rest R is where the tool takes its fulcrum; hence, whatever amount the tool springs or bends from the

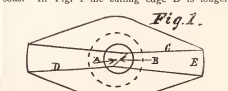


pressure of the cut, it will have but little effect in causing the tool point to enter the work more deeply, the line of motion of the spring or deflection being at C, therefore nearly parallel with the work surface.



Machine-Work Clamps.—To save packing pieces in the accompanying cut, in which A, B, C are flat plates placed on the top of the thread to relieve the friction. The thread being left full at each end of the teeth, the cuttings cannot jam when turning the tap backwards.

Grinding Drills.—Drills that are ground slightly longer on one cutting edge than on another require a great deal of pressure to feed them, for the following reasons. In Fig. 1 the cutting edge D is longer



than the cutting edge C; hence the centre of the cutting edges is at B, whereas the centre of the

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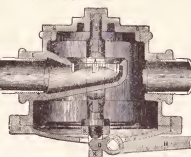
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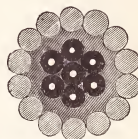
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